Symptom profiles of late-life anxiety and depression: The influence of migration, religion and loneliness

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Anxiety and depression in older adults

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Conflict of interest

All authors declare they have no conflicts of interest.

Ethical approval

Ethical approval for TILDA was granted by the Faculty of Health Sciences Research Ethics Committee of Trinity College Dublin.

Abstract

Objective: To examine: (1) clinically relevant anxiety with comorbid depression in an older population, and the presentation of subthreshold symptoms; (2) to assess anxiety and levels of comorbid depression associated with migration, religion, loneliness and long-term illness.

Method: Analysis of Wave 1 of The Irish Longitudinal Study on Ageing (TILDA) (2009-2011). Latent class analysis (LCA) was used to define indicative diagnoses of anxiety and depression. We then assessed associations between socio-demographic and socio-economic factors, past migration, religious practice, social network, loneliness and long-term illness.

Results: For those with clinically relevant anxiety, LCA derived three classes of self-reported depression: low, sub-threshold and high. Approximately 19% were comorbid, and a further 37% reported subthreshold depression. Compared to those with low/no symptoms of depression, those classed as comorbid were more likely to be male, had lower education levels, had spent more time abroad, lower religious attendance, a limited social network, were lonelier and had long-term life-limiting illness. Those with subthreshold levels of depression reported a more restricted social network and more moderate levels of loneliness.

Conclusion: Findings support the actuality of comorbidity of both disorders. Consequently, government health strategy on detecting and managing social engagement, loneliness and psychological disorders in older people may require a more granulated approach.

Key words: Affective disorders, Anxiety, Public Mental Health, Quality of Life, Treatment

Introduction

Anxiety disorders occur frequently in older populations, are costly and complex to manage (Wolitzky-Taylor, Castriotta, Lenze, Stanley, & Craske, 2010). In psychiatry, comorbidity of anxiety and depression in the elderly is commonly accepted (Gorman, 1996; Maier et al., 2000) – and, in combination, are more persistent and intense (Cairney, Corna, Veldhuizen, Herrmann, & Streiner, 2008) and with higher risk of mortality (Ayers, Sorrell, Thorp, & Wetherell, 2007). Current health care systems can make assessment and treatment problematic; undetected subthreshold symptoms in older people result in inadequate support or treatment (Vink, Aartsen, & Schoevers, 2008) and anxiety and depression combined increase the risk of suicide (Tiller, 2013).

Psychiatric comorbidity of anxiety and depression

Anxiety and depression may result from similar biological mechanisms (Kessler et al., 1996; Wittchen, Beesdo, Bittner, & Goodwin, 2003). Factors associated with both include stressful life events, interpersonal dysfunction, behavioural avoidance and anxiety response styles (Moitra, Herbert, & Forman, 2008; Starr & Davila, 2012). Parmelee *et al*. (1993) reported that, in a sample of elderly people in long-term care, of the 3% meeting DSM-III criteria for anxiety, 60% recorded comorbid depression. Similar and higher levels of co-morbidity have recorded elsewhere (Beekman, de Beurs, van Balkom, Deeg, van Dyck, & van Tilburg, 2000a; Schaub & Linden, 2000; Cairney et al., 2008; Porensky et al., 2009. Thus, Beekman *et al*. (2000) estimated that 47%–50% of older depressed individuals had comorbid anxiety disorder. Several review papers suggest that mixed anxiety–depression is the *typical* presentation in the elderly (Möller et al., 2016). However, because both are comorbid across the life-cycle, the utility of including a *mixed anxiety–depression* disorder specifically for older groups remains ambiguous, and more evaluation is required to establish a mixed

anxiety–depression construct in older people before regarding it as a distinctive presentation. It is thought that this comorbidity manifesting at subsyndrome level is both disabling and undertreated (Culpepper, Clayton, Lieberman III, & Susman, 2008; Dunlop, Scheinberg, & Dunlop, 2013). Considerable research has identified risk factors for depression among the community dwelling elderly (Djernes, 2006) however, we know little about the risk factors for anxiety in later life.

Diagnostic relevance: DSM-V context

Corresponding to ICD-10 criteria, mixed anxiety and depressive disorder (MADD) is defined as co-existing sub-syndrome manifestations of anxiety and depression, serious enough to warrant a psychiatric diagnosis, but with neither distinctly dominant (Möller et al., 2016). Moreover, its efficacy as a diagnostic class remains under dispute (Möller et al., 2016) - it was not incorporated into the recently released DSM-5 because the suggested diagnostic criteria were evaluated and classed as not adequately reliable. Experts have contested the interpretation of MADD based on conflicting results concerning both its diagnostic stability over time, and nosological inconsistencies between sub-threshold and threshold presentations of anxiety and depressive disturbances (Möller et al., 2016).

Zinbarg et al. (1994) (Zinbarg et al., 1994) carried out research on the DSM-IV and noted that patients endorsing criteria for MADD were as prevalent as those with depression, impairment reported by those with MADD was comparable to that of depression and anxiety. Using a sample of cases identified through primary care systems, Stein et al. (1995) (Stein, Kirk, Prabhu, Grott, & Terepa, 1995) established that 12.8% of cases met criteria for MADD

and that the patients evaluated their own disability as proportionate to that noted in cases with anxiety or depressive disturbances.

To examine the nature and extent of this co-occurrence (and attendant subthreshold symptoms of depression) in an older community-based population we analysed data from The Irish Longitudinal Study on Ageing (TILDA) (Kearney et al., 2011). We were also interested in how anxiety and depression may be related to religious observance, migration history and social isolation. Thus, there is a long history of Irish migrants to Britain and elsewhere (Das-Munshi et al., 2013) but less attention has been paid to return migration (Leavey & Eliacin, 2013). Migrants leaving Ireland in the 1950s and1960s - mostly to Great Britain (GB) - were more likely to be single, poorly educated, and arriving without prearranged work or accommodation (Leavey et al., 2004; Das-Munshi et al., 2013). A boosted sample of return migrants were included within the TILDA study, enabling an exploration of post-migration resettlement and mental health status in older age.

Religious identity and adherence may confer health benefits, through increased social capital (e.g. community belonging, material resources) and mechanisms for coping with adversity and misfortune (Curtis & Vincent, 2010). However, Ireland has undergone considerable social and economic change in the past three decades, with increasing secularisation (Cleary & Brannick, 2007). Isolation and loneliness are associated with less engagement in religious practice and can influence mental health outcomes in all age groups, and especially those aged sixty-five or more (Victor & Bowling, 2012).

Social isolation and loneliness

Social isolation is an absence of communication or social exchange with others (Zavaleta & Samuel, 2014) and loneliness has been conceptualised as the disparity between an individual's expectations of social connectedness and actual experience (Stephens, Alpass, Towers, & Stevenson, 2011). Evidence suggests their role in shaping health behaviours (Shankar, Hamer, McMunn, & Steptoe, 2013), and both are reported to have detrimental effects on quality of life, cognition and a variety of physical and psychological health complications (though only isolation had an independent effect on mortality) (Shankar, McMunn, Demakakos, Hamer, & Steptoe, 2017a). In a community-dwelling older population, feelings of loneliness were associated with increased mortality only in older men (Holwerda et al., 2012).

Aims of the Study

To investigate comorbid depression (or subthreshold symptoms) in those with clinically relevant anxiety and their relationship with loneliness, social networks, religious practice and long-term illness. We hypothesise subclasses of varying presentations of anxiety-depression and that coexisting depression is a significant and independent contributing factor to reduced social functioning in those with anxiety.

Sample, measures and methods

All data included in this analysis was from Wave 1 of the TILDA study (2009-2011) (Kearney et al., 2011): a nationally representative community-based sample which comprised 8504 people aged ≥50 years (n=8175) and their spouses or partners, a proportion of whom were

younger than 50 years (n=329, 3.9%). This analysis includes data from two components of data collection: a computer-assisted personal interview (CAPI) administered by trained social researchers in the respondent's home collecting information on social, economic and health characteristics; and a self-completion questionnaire (SCQ) completed by the participant and returned by mail, for more sensitive questions (85% response rate).

Covariates: demographic characteristics were generally time-invariant and included gender, age-group (50-59, 60-69, 70-79 and 80+) and education attainment (primary, secondary and tertiary levels). Characteristics associated with social networks and loneliness included- comfort taken from religion, personal importance of religion, attendance at religious services and perceived loneliness. Migration status was included – with three categories: no migration from Ireland; short-term (one to nine years spent abroad), and long-term (ten or more years) migration

Measures of loneliness and extent of social network

In TILDA, loneliness was measured using a modified version of the University of California - Los Angeles (UCLA) Loneliness Scale (Russell, 1996). Five questions asked about feelings of: lack of companionship; being left out; isolation from others; loneliness; and being *out of tune* with those around you. These were scored from 0 to 2 (respectively hardly ever/never; some of the time, or often), and the responses summed with a final score ranging from 0 (not lonely) to 10 (extremely lonely).

The extent of social networks were quantified using the Berkman-Syme Social Network Index (Berkman & Syme, 1979), which includes four components: (1) marital status - currently married/cohabiting (no/yes); (2) close presence of children, relatives or friends, summarised as presence of at least two children, other relatives or friends (no/yes); (3) membership of church groups - attendance at religious services at least once a month (no/yes); and (4) membership of community organisations such as sports clubs, voluntary associations, self-help or charitable groups etc (no/yes). We rescored the social network index from 0-3 omitting church attendance from the index, to avoid mathematical coupling with 'attendance at religious services'. Social Network Index variables were accumulated generating a summary measure of social engagement – very isolated (0-1), moderately isolated (2), and most integrated (3).

Long-term illness or long term limiting illness (LTLI): To determine illness or life limiting long term illness, questions in the TILDA sample consisted of the following statement and preceding questions. Some people suffer from chronic or long-term health problems. By long-term we mean it has troubled you over a period of time or is likely to affect you over a period of time. 1. Do you have any long-term health problems, illness, disability or infirmity? (yes/no); and 2. Does this illness or disability limit your activities in any way? (yes/no).

Loneliness: A measure of *perceived loneliness* was drawn directly from the questionnaire – this had four categories ranging from *none* to lonely *all the time*.

Depression: symptoms (experienced in the seven days preceding the survey) were assessed using the 20-item Centre for Epidemiologic Studies Depression (CES-D) (Radloff, 1977), and listed in Table 2 below - each scored on a scale from 0 (rarely/never) to 3 (five to seven days), accumulated to generate a scale of increasing severity from 0 to 60 and, using a standard cut-off of sixteen or more, recoded as a binary measure. The CES-D cut off score (16 or greater) aids in identifying individuals at risk for clinical depression. Its validity as a measure of depression in community-dwelling older adults is well-documented (Lewinsohn, Seeley, Roberts, & Allen, 1997) and, when tested on older adults living in the community, is reported to have 100% sensitivity and adequate specificity (88%) for assessing major depression (Beekman, de Beurs, van Balkom, Deeg, van Dyck, & van Tilburg, 2000a).

Anxiety: symptoms were assessed using the anxiety subscale of the Hospital Anxiety and Depression Scale (HADS-A) (Zigmond & Snaith, 1983), again listed in Table 2. As used here this comprised seven items each scored on a four-point scale from 0 (not at all) to 3 (very often). These were accumulated to generate a scale of increasing severity from 0 to 21 and, using a cut-off of eight or more, recoded as a binary variable. A cut point of ≥8 has previously been reported to provide the optimal balance between sensitivity (0.89) and specificity (0.75) for generalised anxiety disorder (Olssøn, Mykletun, & Dahl, 2005).

Analysis: statistical analyses were conducted using Mplus version 8. Latent class analysis (LCA) determined patterns of anxiety and depression based on responses to the symptoms listed (see table 1). We sought a parsimonious model that indexed the differential nature of reporting the symptom experience. Finally, logistic regression was used to quantify the association between the distribution of the three classes and the explanatory co-variates.

Latent Class Analysis to derive profiles for clinically relevant anxiety and levels of depression symptoms: Table 2 shows the Fit indices associated with LCA for symptoms of an anxiety or depression symptoms, the models including twenty indicators of depression and anxiety (itemised in Table 1). Solutions for six classes were estimated and interpreted, with log-likelihoods, information criteria (IC) and classification accuracy reported. To identify the best solution, we followed the recommended approach and considered a combination of statistical criteria (ICs, and LRT), model parsimony, interpretability and meaningfulness of the model (Collins & Lanza, 2010), and the need for theory and judgement when deciding the class structure (Hickendorff, Edelsbrunner, McMullen, Schneider, & Trezise, 2018). The three-class solution provided a more parsimonious and theoretically meaningful model (particularly compared to the four-class solution). Information statistics (AIC, BIC and SSABIC) were lower for the three-class than the two-class solution and with four-classes the LRT became non-significant, suggesting it also was inferior. The entropy value of 0.84 further indicates good classification of participants to each of the latent subgroups.

This three-class solution (Figure 1) – derived from a population of people with anxiety - includes: (1) *no or extremely low depression* (44% of the sample); (2) *borderline depression* (37%), scoring mid-range on the probability for experiencing depression symptoms; and (3) *depression* (19%), with a high probability of reporting symptoms of depression.

Results

The analysis presented here is based on 8,504 respondents to the TILDA study aged fifty years or more, of which 20.0% (n=1,707) reported symptoms of anxiety and 9.5% (n=809) symptoms of depression. Table 1 reports the prevalence of the listed symptoms of anxiety and depression amongst those with either anxiety or depression. In respondents scoring above the cut-off for anxiety: 60% reported restless sleep; 47% feeling sad; 45% had trouble keeping their mind on what they were doing; 40% and 37% respectively felt that everything was an effort or could not *get going*; 35% reported feeling lonely; while feeling unhappy, not enjoying life, feeling like they were inadequate and not feeling hopeful about the future was reported less often (8%, 7%, 9% and 13% respectively).

Table 3 presents three incrementally adjusted models examining the relationship between the associated demographic variables, religion, loneliness, social network and health in predicting and membership of the comorbid anxiety and depression class; clinically relevant anxiety with no or extremely low depression symptoms is the reference group. In model 1, compared with the anxiety but no or extremely low depression class, those reporting 'comorbid anxiety and depression' were more likely to be male than female (OR=1.49: 95%CI=1.11, 1.99); less likely to be aged between 60-69 years and more likely to be less well-educated (OR=0.59: 0.41, 0.84 and OR=1.99: 1.48, 2.67 respectively); more likely to have lived abroad as a long-term migrant and less likely to attend religious services than those attending on a weekly basis (OR=1.79: 1.08, 2.97 and OR=2.14: 1.49, 3.08 respectively). With the addition of the indicator of social network in model 2: most factors remain significant, albeit attenuated, with the exception of long-term migrant status; social network has strong and significant effects. Finally, in model 3, With the addition of the

indicators of loneliness and health: most factors remain significant, with the exception of gender and long-term migrant status; indicators of loneliness, have very strong and significant effects and the addition of long-term illness shows a strong independent effect (OR=2.77: 1.88, 4.07), with little impact on the other indicators of the model.

Table 4 presents a similar structure – this time modelling the factors associated with anxiety with borderline depression symptoms (again with anxiety with no or extremely low depression as the reference group). Overall, Table 4 shows more muted effects – in the fully adjusted model loneliness accounts for a large proportion of the variance, respondents report feeling lonely *sometimes*, *most of the time* or, notably, being less likely to feel *lonely all of the time* (OR=2.45: 1.78, 3.37; OR=1.67: 1.12, 2.49; and OR=0.41: 0.21, 0.81 respectively). Respondents from TILDA who report 'anxiety with a borderline depression symptoms' are also more likely to report having a limited social network (OR=0.80: 0.69, 0.93).

Discussion

Clinical and methodological implications

We found within this large representative sample of older people that approximately 19% were comorbid, and a further 37% reported subthreshold depression. Compared to those with low/no symptoms of depression: those classed as comorbid were more likely to be male, less educated, had migrated for longer periods, attended church less, had smaller social networks, were lonelier and had a long-term life-limiting illness. Moreover, people with subthreshold levels of depression reported a more restricted social network and more moderate levels of loneliness. The initial associations with gender and past migration were no longer evident in the fully adjusted models. However, future analysis to investigate gender differences and past migration in more detail is warranted.

As in other studies we noted an increase in prevalence of risk factors such as poorer physical health, cognitive decline and a diminishing social network in older community dwelling adults (Beekman, de Beurs, van Balkom, Deeg, van Dyck, & van Tilburg, 2000b). Our findings that males are more likely to report comorbid symptoms and loneliness support findings from a community-dwelling older population, where feelings of loneliness were most prevalent in older men (Holwerda et al., 2012) which additionally showed an increased likelihood of mortality, approx. 30% at a 10-year follow-up (Holwerda et al., 2012).

Importantly, we noted associations between gender, past migration, emotional and social loneliness and long-term life-limiting illness. Consequently, policy could develop in two areas: (1) identifying high risk individuals experiencing subthreshold symptoms, which could be reduced through developing social interventions; and (2) because loneliness is a significant

predictor of mental ill-health, policy should be directed towards developing a range of intervention strategies, including return migrants who are vulnerable to loneliness and mental health problems.

Our study has clinical and diagnostic significance: anxiety and depression are seldom distinct and a *mixed* presentation, common; depression may be present, though insufficient to support a clinical level, possibly explained by common underlying neurobiological mechanisms. Thus, chronic inflammation connected with high oxidation are involved in the development of both disorders (Glaus et al., 2014; Shahzad et al., 2014).

Epidemiological findings suggest that sub-syndrome anxiety or depression is often unrecognised, and consequently under-treated (Culpepper et al., 2008; Dunlop et al., 2013) and may constitute up to half of all psychological problems and are four-times more common than depression alone (Singleton et al., 2003). Comorbidity may impede treatment responsiveness - in one study older adults with depression and concurrent anxiety symptoms required 50% more time to respond to antidepressants (Mulsant, Reynolds, Shear, Sweet, & Miller, 1996) and, in young adult samples, the more severe the depressive symptoms in individuals with comorbid anxiety disorders, the more time needed to recover (Brown, Chorpita, Korotitsch, & Barlow, 1997). Likewise, anxiety disorder treatment is less effective when major depressive episodes co-occur (Abramowitz & Foa, 2000).

More evidence is needed to resolve the debate around DSM-V criteria and on risk and effective treatments for sub-syndrome anxiety and depressive symptoms.

Determinants of mental ill-health

Health risks associated with loneliness and social isolation are now well-acknowledged (Courtin & Knapp, 2017; Holt-Lunstad, Smith, & Layton, 2010; Newall, Chipperfield, Bailis, & Stewart, 2013). Social and emotional loneliness can create these health disturbances through a negative influence on health behaviours or through biological processes (Shankar, McMunn, Banks, & Steptoe, 2011). Our study confirms that social loneliness and having fewer close ties is a significant feature of the lives of those who have comorbid anxiety and depression / subthreshold depression. We found that mental ill-health is associated with decreased attendance at religious services and is a significant feature of the lives of male return migrants (who spent longer than ten years away), a possible indicator of readjustment disaffection with religion. Social loneliness and isolation - dominating features of the fully adjusted models - are consistent with qualitative research on the experiences of returning migrants (Barrett & Mosca, 2013; Ryan, Jorm, Toumbourou, & Lubman, 2015). Although longer-term male return migrants are more likely to report mental ill-health- we note that this effect disappears in the fully adjusted model.

Study limitations and implications

The modified version of the UCLA Loneliness Scale may be insufficient to capture loneliness in the TILDA sample with the average loneliness score being relatively low - around two on a scale from zero (not lonely) to ten (lonely) (Barrett & Mosca, 2013); and Timonen *et al*. (2011) (Timonen, Kamiya, & Maty, 2011) suggest 60% of respondents who are *objectively* socially isolated report that they never feel isolated from others. However, we noted that a majority of individuals with anxiety and depression score higher than two, confirming the

efficacy of the modified UCLA Scale within an anxious population. We note that although the overall proportion of loneliness is low, the majority who report loneliness are at increased risk of comorbid anxiety and depression/subthreshold depression. Also, while the study highlights concern around social isolation among older people living with anxiety and depression and its consequences, the study cannot address issues of precedence - whether anxiety precedes a depressed mood or not, functioning as a precipitating chronic stressor.

The CES-D and HADS-A are useful as initial screening tools to identify participants who need further in-depth assessment of their depressive or anxious symptoms. However, it must be noted that they are not stand-alone diagnostic tools. In a clinical setting it is recommended that additional diagnostic evaluations are required for all participants with scores greater than the specified cut off points. Specifically, follow-up diagnostic evaluations are needed to confirm a diagnosis and also to distinguish depressive disorders and anxiety disorders.

Finally, this study furthers our understanding of the co-occurrence of anxious and depressed mood. As noted, planned revisions of the DSM may significantly alter how such comorbidities are reconceptualised (including at subthreshold level where symptoms may be reshaped to form a single disorder) (Goldberg, 2010). Given this, further analyses focussing on the epidemiology of sub-threshold symptoms are warranted.

Data availability statement: The anonymised TILDA dataset is publicly available to researchers who meet the criteria for access, at no monetary cost, from the Irish Social Science Data Archive (ISSDA) at University College Dublin (http://www.ucd.ie/issda/data/tilda/). TILDA also considers applications for privileged access to the dataset through an onsite "hot desk" facility based in TILDA (visit www.tilda.ie for further information).

Results tables:

Table 1: Frequency of anxiety or depressive symptoms in those with clinically relevant anxiety (HADS-A) or depression (CES-D), reported in the Computer Assisted Personal Interview (CAPI).

Depression and anxiety symptoms listed in the CES-D and HADS-A	Total sample 8,504 (%)	Anxiety 1707 (20.0%)	Depression 809 (9.5%)
Questions from the anxiety subscale			
I feel tense or wound up	5662 (66.6)	1693 (99.2)	582 (95.7)
Frightened feeling something awful about to happen	3877 (45.6)	1615 (94.6)	499 (81.8)
Worrying thoughts	4329 (50.9)	1659 (97.2)	533 (86.4)
I do not sit at ease and feel relaxed	83 (1.0)	46 (2.7)	24 (3.9)
Frightened feeling like 'butterflies' in the stomach	6988 (82.2)	1592 (93.3)	593 (95.3)
I feel restless as if I have to be on the move	4963 (58.4)	1660 (97.2)	562 (90.1)
I get sudden feelings of panic	3127 (36.8)	1562 (91.5)	507 (81.1)
Questions from the depression subscale			
Bothered by things that usually don't bother me	1718 (20.2)	648 (38.0)	563 (69.6)
I did not feel like eating	1003 (11.8)	341 (20.0)	417 (51.5)
I could not shake off the blues even with help	1137 (13.4)	516 (30.3)	594 (73.4)
I felt that I was not as good as other people	670 (7.9)	149 (8.8)	124 (18.7)
Trouble keeping my mind on what I was doing	2238 (26.3)	771 (45.2)	631 (78.0)
I felt depressed	1536 (18.1)	646 (37.9)	679 (83.9)
I felt that everything I did was an effort	1769 (20.8)	676 (39.6)	690 (85.3)
I did not feel hopeful about the future	716 (8.4)	212 (12.5)	187 (23.1)
I thought my life had been a failure	761 (8.9)	326 (19.1)	404 (49.9)
I felt fearful	1293 (15.2)	569 (33.4)	534 (66.0)
My sleep was restless	3420 (40.2)	1029 (60.3)	688 (85.0)
I was not happy	393 (4.6)	127 (7.5)	118 (14.6)
I talked less than usual	1305 (15.3)	472 (27.7)	516 (63.8)
I felt lonely	1599 (18.8)	588 (34.5)	592 (73.2)
People were unfriendly	738 (8.7)	258 (15.2)	275 (34.0)
I did not enjoy life	365 (4.3)	118 (6.9)	116 (14.3)
I had crying spells	961 (11.3)	368 (21.6)	435 (53.8)
I felt sad	2236 (26.3)	802 (47.0)	718 (88.8)
I felt that people disliked me	549 (6.5)	215 (12.6)	272 (33.6)
I could not get 'going'	1660 (19.5)	624 (36.6)	632 (78.1)

Anxiety symptoms were assessed with the anxiety subscale of the Hospital Anxiety and Depression Scale (HADS-A) (Zigmond and Snaith, 1983), which measures the presence of anxiety symptoms with no specific time frame.

Depressive symptoms were assessed by the 20-item Center for Epidemiologic Studies Depression (CES-D) (Radloff, 1977) which assesses symptoms experienced in the seven days preceding the survey.

Table 2: Fit indices of the LCA to profile depression symptoms in individuals with clinically relevant anxiety.

Model	Log	Free	AIC	BIC	SSABIC	LRT	ρ	Entropy
1 Class	-20286	27	40627	40774	40688			1.00
2 Classes	-17318	55	34747	35046	34871	5907	0·00	0.90
3 Classes	**-16874**	**83**	**33915**	**34367**	**34103**	**883**	**0·00**	**0.84**
4 Classes	--16733	111	33688	34292	33939	281	0.05	0.79
5 Classes	-16640	139	33559	34316	33874	183	0·18	0.81
6 Classes	-16566	167	33466	34374	33844	148	0·63	0.82

Log= log likelihood function, maximum likelihood estimation. Free= free parameters, LRX2= likelihood ratio chi-square. AIC= Akaike information criteria. BIC= Bayesian information criteria. SSABIC= Sample size adjusted BIC. LRT= Lo-Mendell-Rubin adjusted likelihood ratio test.

Figure 1:

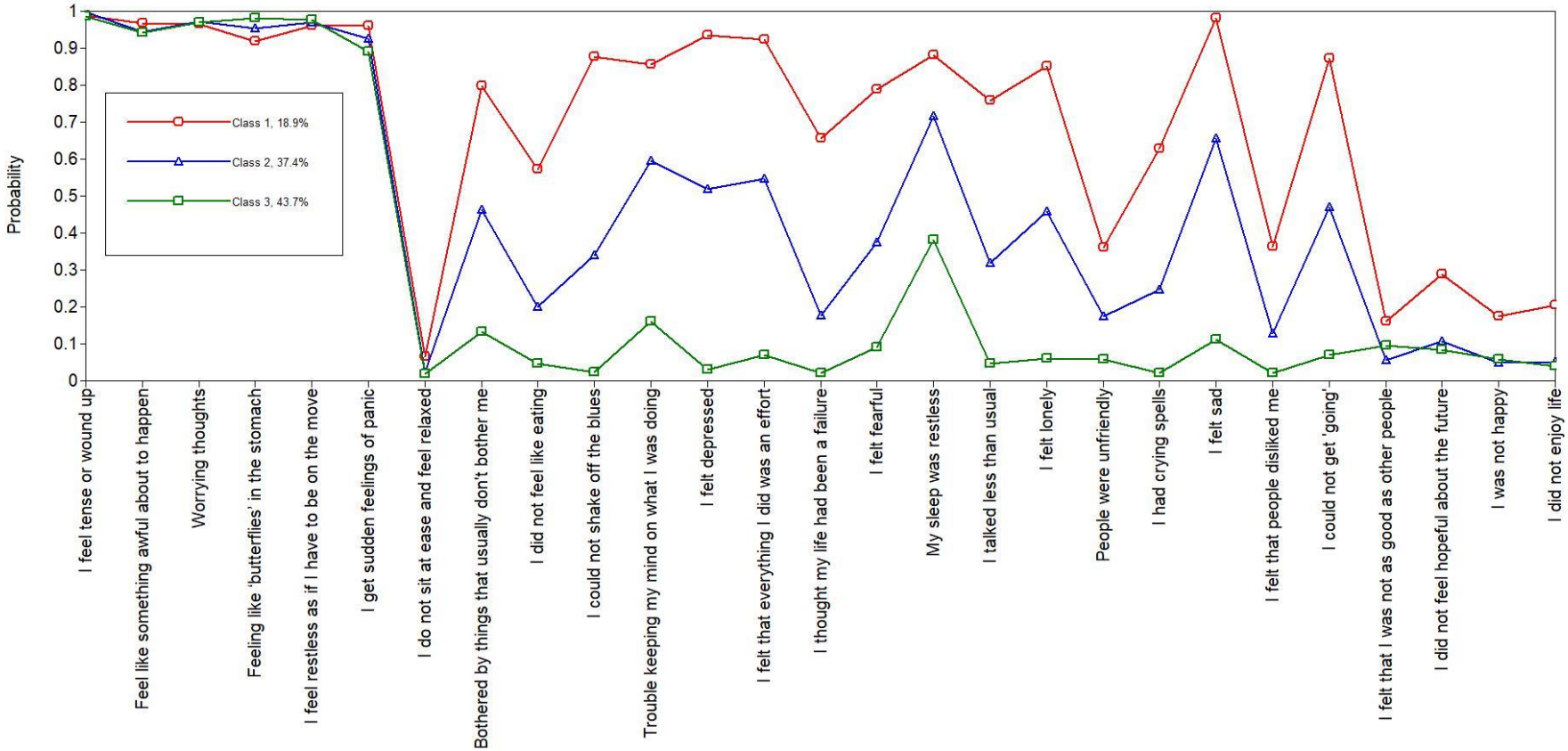
Probability
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
Class 1, 18.9%
Class 2, 37.4%
Class 3, 43.7%
I feel tense or wound up
Feel like something awful about to happen
Worrying thoughts
Feeling like 'butterflies' in the stomach
I feel restless as if I have to be on the move
I get sudden feelings of panic
I do not sit at ease and feel relaxed
Bothered by things that usually don't bother me
I did not feel like eating
I could not shake off the blues
Trouble keeping my mind on what I was doing
I felt depressed
I felt that everything I did was an effort
I thought my life had been a failure
I felt fearful
My sleep was restless
I talked less than usual
I felt lonely
People were unfriendly
I had crying spells
I felt sad
I felt that people disliked me
I could not get 'going'
I felt that I was not as good as other people
I did not feel hopeful about the future
I was not happy
I did not enjoy life

Table 3: Demographic variables, religion, social network, loneliness, and health predicting latent class membership to latent class 1 'comorbid anxiety and depression'.

Covariates		**Model 1: comorbid anxiety / depression**	**Model 2: comorbid anxiety / depression**	**Fully Adjusted Model: comorbid anxiety / depression**
Gender	Female Male	1.00 **1.49 (1.11, 1.99)***	1.00 **1.39 (1.04, 1.87)***	1.00 1.16 (0.80, 1.67)
Age at interview	50-59 60-69 70-79 80+	1.00 **0.59 (0.41, 0.84)*** 0.85 (0.54, 1.34) 0.60 (0.29, 1.27)	1.00 **0.60 (0.42, 0.86)*** 0.82 (0.52, 1.28) 0.51 (0.24, 1.08)	1.00 **0.56 (0.36, 0.87)** 0.66 (0.37, 1.21) 0.37 (0.13, 1.09)
Education	Secondary level Primary school level Tertiary (Degree or Higher)	1.00 **1.99 (1.48, 2.67)*** 0.90 (0.56, 1.42)	1.00 **1.82 (1.35, 2.47)*** 0.94 (0.59, 1.49)	1.00 **1.63 (1.10, 2.43)*** 0.88 (0.50, 1.54)
Migrant Status	Never migrated Short term migrant (<10 years) Long term migrant (10+ years)	1.00 1.16 (0.75, 1.79) **1.79 (1.08, 2.97)***	1.00 1.11 (0.72, 1.70) 1.66 (0.99, 2.76)	1.00 1.15 (0.69, 1.92) 1.24 (0.55, 2.82)
Comfort from Religion	Yes No	1.00 0.83 (0.55, 1.26)	1.00 0.89 (0.58, 1.35)	1.00 1.01 (0.59, 1.72)
Personal importance of Religion	Very important Somewhat important Not important	1.00 0.80 (0.55, 1.15) 0.77 (0.46, 1.28)	1.00 0.79 (0.55, 1.14) 0.82 (0.49, 1.37)	1.00 1.23 (0.77, 1.95) 1.07 (0.54, 2.11)
Religious services attendance	Once a week or more 1-2 times monthly or less 1-2 times a year or never	1.00 **2.14 (1.49, 3.08)*** **1.75 (1.20, 2.54)***	1.00 **1.93 (1.33, 2.80)*** **1.72 (1.18, 2.50)***	1.00 **1.62 (1.01, 2.60)*** 1.59 (0.94, 2.67)
Social network	0 through to 3		**0.63 (0.51, 0.78)***	1.16 (0.87, 1.53)
Perceived loneliness	Not lonely Sometimes Most of the time All of the time			1.00 **9.44 (5.73, 15.57)*** **14.75 (8.46, 25.72)*** **73.23 (32.25, 166.30)***
UCLA lonely	0 through to 10			**1.17 (1.08, 1.26)***
Health	No illness Long-term illness Limiting long-term illness			1.00 1.38 (0.77, 2.45) **2.77 (1.88, 4.07)***

Table 4: Demographic variables, religion, social network, loneliness, and health predicting latent class membership to latent class 2 'anxiety and borderline depression symptoms'.

Covariates		**Model 2: anxiety / borderline depression**	**Model 2: anxiety / borderline depression**	**Fully Adjusted Model: anxiety / borderline depression**
Gender	Female Male	1.00 1.20 (0.95, 1.52)	1.00 1.16 (0.91, 1.47)	1.00 1.11 (0.87, 1.43)
Age: at interview	Age 50-59 60-69 70-79 80+	1.00 1.07 (0.82, 1.39) 0.99 (0.70, 1.38) 1.18 (0.66, 2.11)	1.00 1.08 (0.83, 1.41) 0.96 (0.69, 1.35) 1.07 (0.60, 1.91)	1.00 1.08 (0.82, 1.43) 1.01 (0.71, 1.44) 1.14 (0.65, 1.99)
Education	Secondary level Primary school level University Degree or Higher	1.00 0.84 (0.66, 1.06) 0.90 (0.65, 1.24)	1.00 0.80 (0.62, 1.02) 0.92 (0.67, 1.27)	1.00 0.79 (0.61, 1.03) 0.96 (0.69, 1.34)
Migrant Status	Never migrated Short term migrant (<10 years) Long term migrant (10+ years)	1.00 0.85 (0.61, 1.19) 0.87 (0.56, 1.34)	1.00 0.83 (0.59, 1.17) 0.83 (0.53, 1.29)	1.00 0.88 (0.62, 1.24) 0.81 (0.51, 1.29)
Comfort from Religion	Yes No	1.00 1.10 (0.77, 1.57)	1.00 1.14 (0.80, 1.62)	1.00 1.24 (0.85, 1.82)
Personal importance of Religion	Very important Somewhat important Not important	1.00 0.77 (0.59, 1.00) 1.03 (0.67, 1.59)	1.00 0.76 (0.58, 1.00) 1.07 (0.69, 1.64)	1.00 0.79 (0.60, 1.05) 1.07 (0.67, 1.72)
Religious services attendance	Once a week or more 1-2 times monthly or less 1-2 times a year or never	1.00 1.18 (0.86, 1.63) 1.36 (1.00, 1.85)	1.00 1.12 (0.81, 1.54) 1.33 (0.97, 1.81)	1.00 1.16 (0.83, 1.62) 1.30 (0.93, 1.82)
Social network	0 through to 3		**0.80 (0.69, 0.93)***	0.85 (0.72, 1.01)
Perceived loneliness	Not lonely Sometimes Most of the time All of the time			1.00 **2.45 (1.78, 3.37)*** **1.67 (1.12, 2.49)*** **0.41 (0.21, 0.81)***
UCLA lonely	0 through to 10			1.02 (0.96, 1.07)
Health	No illness Long-term illness Limiting long-term illness			1.00 1.11 (0.79, 1.56) 1.17 (0.90, 1.52)

References

Abramowitz, J. S., & Foa, E. B. (2000). Does comorbid major depressive disorder influence outcome of exposure and response prevention for OCD? *Behavior Therapy, 31*(4), 795-800.

Aspinall, P. J. (2002). Suicide amongst Irish migrants in Britain: A review of the identity and integration hypothesis. *International Journal of Social Psychiatry, 48*(4), 290-304.

Ayers, C. R., Sorrell, J. T., Thorp, S. R., & Wetherell, J. L. (2007). Evidence-based psychological treatments for late-life anxiety. *Psychology and Aging, 22*(1), 8.

Barrett, A., & Mosca, I. (2013). The psychic costs of migration: Evidence from Irish return migrants. *Journal of Population Economics, 26*(2), 483-506.

Beekman, A. T., de Beurs, E., van Balkom, A. J., Deeg, D. J., van Dyck, R., & van Tilburg, W. (2000a). Anxiety and depression in later life: Co-occurrence and communality of risk factors. *American Journal of Psychiatry, 157*(1), 89-95.

Beekman, A. T., de Beurs, E., van Balkom, A. J., Deeg, D. J., van Dyck, R., & van Tilburg, W. (2000b). Anxiety and depression in later life: Co-occurrence and communality of risk factors. *American Journal of Psychiatry, 157*(1), 89-95.

Berkman, L. F., & Syme, S. L. (1979). Social networks, host resistance, and mortality: A nine-year follow-up study of alameda county residents. *American Journal of Epidemiology, 109*(2), 186-204.

Brown, T. A., Chorpita, B. F., Korotitsch, W., & Barlow, D. H. (1997). Psychometric properties of the depression anxiety stress scales (DASS) in clinical samples. *Behaviour Research and Therapy, 35*(1), 79-89.

Cairney, J., Corna, L. M., Veldhuizen, S., Herrmann, N., & Streiner, D. L. (2008). Comorbid depression and anxiety in later life: Patterns of association, subjective well-being, and impairment. *The American Journal of Geriatric Psychiatry, 16*(3), 201-208.

Clark, D. M. (2011). Implementing NICE guidelines for the psychological treatment of depression and anxiety disorders: The IAPT experience. *International Review of Psychiatry, 23*(4), 318-327.

Cleary, A., & Brannick, T. (2007). Suicide and changing values and beliefs in Ireland. *Crisis: The Journal of Crisis Intervention and Suicide Prevention, 28*(2), 82.

Collins, L. M., & Lanza, S. T. (2010). Latent class analysis with covariates. *Latent Class and Latent Transition Analysis: With Applications in the Social, Behavioral, and Health Sciences*, Hoboken, NJ: Wiley, 149-177.

Courtin, E., & Knapp, M. (2017). Social isolation, loneliness and health in old age: A scoping review. *Health & Social Care in the Community, 25*(3), 799-812.

Craske, M., & Stein, M. (2016). *Anxiety.Lancet Published Online June 24, 2016,*

Culpepper, L., Clayton, A., Lieberman III, J., & Susman, J. (2008). Treating depression and anxiety in primary care. *Prim Care Companion J Clin Psychiatry, 10*(2), 145-152.

Curtis, J. R., & Vincent, J. (2010). Ethics and end-of-life care for adults in the intensive care unit. *The Lancet, 376*(9749), 1347-1353.

Das-Munshi, J., Clark, C., Dewey, M. E., Leavey, G., Stansfeld, S. A., & Prince, M. J. (2013). Does childhood adversity account for poorer mental and physical health in second-generation Irish people living in Britain? birth cohort study from Britain (NCDS). *BMJ Open, 3*(3), 10.1136/bmjopen-2012-001335. doi:10.1136/bmjopen-2012-001335 [doi]

Djernes, J. K. (2006). Prevalence and predictors of depression in populations of elderly: A review. *Acta Psychiatrica Scandinavica, 113*(5), 372-387.

Dunlop, B. W., Scheinberg, K., & Dunlop, A. L. (2013). Ten ways to improve the treatment of depression and anxiety in adults. *Mental Health in Family Medicine, 10*(3), 175-181.

Durcan, D., & Bell, R. (2015). Reducing social isolation across the life course. *Public Health England: London, UK*,

Edition, F., & American Psychiatric Association. (2013). Diagnostic and statistical manual of mental disorders. *Arlington: American Psychiatric Publishing*,

Glaus, J., Vandeleur, C. L., von Känel, R., Lasserre, A. M., Strippoli, M. F., Gholam-Rezaee, M., Merikangas, K. (2014). Associations between mood, anxiety or substance use disorders and inflammatory markers after adjustment for multiple covariates in a population-based study. *Journal of Psychiatric Research, 58*, 36-45.

Goldberg, D. P., (2010). *Diagnostic issues in depression and generalized anxiety disorder: Refining the research agenda for DSM-V.* Arlington: American Psychiatric Association.

Gorman, J. M. (1996). Comorbid depression and anxiety spectrum disorders. *Depression and Anxiety*, *4*(4), 160-168.

Hickendorff, M., Edelsbrunner, P. A., McMullen, J., Schneider, M., & Trezise, K. (2018). Informative tools for characterizing individual differences in learning: Latent class, latent profile, and latent transition analysis. *Learning and Individual Differences, 66*, 4-15.

Hofmann, S. G. (2014). Interpersonal emotion regulation model of mood and anxiety disorders. *Cognitive Therapy and Research, 38*(5), 483-492.

Holt-Lunstad, J., Smith, T. B., Baker, M., Harris, T., & Stephenson, D. (2015). Loneliness and social isolation as risk factors for mortality: A meta-analytic review. *Perspectives on Psychological Science, 10*(2), 227-237.

Holt-Lunstad, J., Smith, T. B., & Layton, J. B. (2010). Social relationships and mortality risk: A meta-analytic review. *PLoS Medicine, 7*(7), e1000316.

Holwerda, T. J., Beekman, A. T., Deeg, D. J., Stek, M. L., van Tilburg, T. G., Visser, P. J., Schoevers, R. A. (2012). Increased risk of mortality associated with social isolation in older men: Only when feeling lonely? results from the Amsterdam study of the elderly (AMSTEL). *Psychological Medicine, 42*(4), 843-853.

Kearney, P. M., Cronin, H., O'regan, C., Kamiya, Y., Savva, G. M., Whelan, B., & Kenny, R. (2011). Cohort profile: The Irish longitudinal study on ageing. *International Journal of Epidemiology, 40*(4), 877-884.

Kessler, R. C., Nelson, C. B., McGonagle, K. A., Liu, J., Swartz, M., & Blazer, D. G. (1996). Comorbidity of DSM–III–R major depressive disorder in the general population: Results from the US national comorbidity survey. *The British Journal of Psychiatry, 168*(S30), 17-30.

Leavey, G., Sembhi, S., & Livingston, G. (2004). Older Irish migrants living in London: identity, loss and return. *Journal of Ethnic and Migration Studies, 30*(4), 763-779.

Leavey, G., & Eliacin, J. (2013). The past is a foreign country': Vulnerability to mental illness among return migrants. *Return migration in later life: International perspectives*, 195-218.

Lenze, E. J., Mulsant, B. H., Shear, M. K., Alexopoulos, G. S., Frank, E., & Reynolds, C. F. (2001). Comorbidity of depression and anxiety disorders in later life. *Depression and Anxiety, 14*(2), 86-93.

Lewinsohn, P. M., Seeley, J. R., Roberts, R. E., & Allen, N. B. (1997). Center for epidemiologic studies depression scale (CES-D) as a screening instrument for depression among community-residing older adults. *Psychology and Aging, 12*(2), 277.

Li, M., D'arcy, C., & Meng, X. (2016). Maltreatment in childhood substantially increases the risk of adult depression and anxiety in prospective cohort studies: Systematic review, meta-analysis, and proportional attributable fractions. *Psychological Medicine, 46*(4), 717-730.

Maier, W., Gänsicke, M., Freyberger, H., Linz, M., Heun, R., & Lecrubier, Y. (2000). Generalized anxiety disorder (ICD-10) in primary care from a cross-cultural perspective: A valid diagnostic entity? *Acta Psychiatrica Scandinavica, 101*(1), 29-36.

McManus, S., Meltzer, H., Brugha, T., Bebbington, P., & Jenkins, R. (2009). *Adult psychiatric morbidity in England, 2007: Results of a household survey* The NHS Information Centre for health and social care.

Moitra, E., Herbert, J. D., & Forman, E. M. (2008). Behavioral avoidance mediates the relationship between anxiety and depressive symptoms among social anxiety disorder patients. *Journal of Anxiety Disorders, 22*(7), 1205-1213.

Möller, H., Bandelow, B., Volz, H., Barnikol, U. B., Seifritz, E., & Kasper, S. (2016). The relevance of ‘mixed anxiety and depression’as a diagnostic category in clinical practice. *European Archives of Psychiatry and Clinical Neuroscience, 266*(8), 725-736.

Mulsant, B. H., Reynolds III, C. F., Shear, M. K., Sweet, R. A., & Miller, M. (1996). Comorbid anxiety disorders in late-life depression. *Anxiety, 2*(5), 242-247.

Newall, N. E., Chipperfield, J. G., Bailis, D. S., & Stewart, T. L. (2013). Consequences of loneliness on physical activity and mortality in older adults and the power of positive emotions. *Health Psychology, 32*(8), 921.

Olssøn, I., Mykletun, A., & Dahl, A. A. (2005). The hospital anxiety and depression rating scale: A cross-sectional study of psychometrics and case finding abilities in general practice. *BMC Psychiatry, 5*(1), 46.

Parmelee, P. A., Katz, I. R., & Lawton, M. P. (1993). Anxiety and its association with depression among institutionalized elderly. *The American Journal of Geriatric Psychiatry, 1*(1), 46-58.

Porensky, E. K., Dew, M. A., Karp, J. F., Skidmore, E., Rollman, B. L., Shear, M. K., & Lenze, E. J. (2009). The burden of late-life generalized anxiety disorder: Effects on disability, health-related quality of life, and healthcare utilization. *The American Journal of Geriatric Psychiatry, 17*(6), 473-482.

Radloff, L. S. (1977). The CES-D scale: A self-report depression scale for research in the general population. *Applied Psychological Measurement, 1*(3), 385-401.

Russell, D. W. (1996). UCLA loneliness scale (version 3): Reliability, validity, and factor structure. *Journal of Personality Assessment, 66*(1), 20-40.

Ryan, L., Leavey, G., Golden, A., Blizard, R., & King, M. (2006). Depression in Irish migrants living in london: Case-control study. *The British Journal of Psychiatry, 188*(6), 560-566.

Ryan, S. M., Jorm, A. F., Toumbourou, J. W., & Lubman, D. I. (2015). Parent and family factors associated with service use by young people with mental health problems: A systematic review. *Early Intervention in Psychiatry*, n/a-n/a. doi:10.1111/eip.12211

Schaub, R. T., & Linden, M. (2000). Anxiety and anxiety disorders in the old and very old—results from the berlin aging study (BASE). *Comprehensive Psychiatry, 41*(2), 48-54.

Shahzad, N., Ahmad, J., Khan, W., Al-Ghamdi, S. S., Ain, M. R., Ibrahim, I. A. A., . . . Khanam, R. (2014). Interactions of atenolol with alprazolam/escitalopram on anxiety, depression and oxidative stress. *Pharmacology Biochemistry and Behavior, 117*, 79-84.

Shankar, A., Hamer, M., McMunn, A., & Steptoe, A. (2013). Social isolation and loneliness: Relationships with cognitive function during 4 years of follow-up in the English longitudinal study of ageing. *Psychosomatic Medicine, 75*(2), 161-170.

Shankar, A., McMunn, A., Banks, J., & Steptoe, A. (2011). Loneliness, social isolation, and behavioral and biological health indicators in older adults. *Health Psychology, 30*(4), 377.

Shankar, A., McMunn, A., Demakakos, P., Hamer, M., & Steptoe, A. (2017a). Social isolation and loneliness: Prospective associations with functional status in older adults. *Health Psychology, 36*(2), 179.

Shankar, A., McMunn, A., Demakakos, P., Hamer, M., & Steptoe, A. (2017b). Social isolation and loneliness: Prospective associations with functional status in older adults. *Health Psychology, 36*(2), 179.

Singleton, N., Bumpstead, R., O'Brien, M., Lee, A., & Meltzer, H. (2003). Psychiatric morbidity among adults living in private households, 2000. *International Review of Psychiatry, 15*(1-2), 65-73.

Starr, L. R., & Davila, J. (2012). Cognitive and interpersonal moderators of daily co-occurrence of anxious and depressed moods in generalized anxiety disorder. *Cognitive Therapy and Research, 36*(6), 655-669.

Stein, M. B., Kirk, P., Prabhu, V., Grott, M., & Terepa, M. (1995). Mixed anxiety-depression in a primary-care clinic. *Journal of Affective Disorders, 34*(2), 79-84. doi:0165032795000025 [pii]

Stephens, C., Alpass, F., Towers, A., & Stevenson, B. (2011). The effects of types of social networks, perceived social support, and loneliness on the health of older people: Accounting for the social context. *Journal of Aging and Health, 23*(6), 887-911.

Stern, A. F. (2014). The hospital anxiety and depression scale. *Occupational Medicine, 64*(5), 393-394.

Sundström, G., Fransson, E., Malmberg, B., & Davey, A. (2009). Loneliness among older europeans. *European Journal of Ageing, 6*(4), 267.

Tiller, J. W. (2013). Depression and anxiety. *The Medical Journal of Australia, 199*(6), 28-31.

Timonen, V., Kamiya, Y., & Maty, S. (2011). Social engagement of older people. *Fifty Plus in Ireland 2011, 51*

Victor, C. R., & Bowling, A. (2012). A longitudinal analysis of loneliness among older people in great britain. *The Journal of Psychology, 146*(3), 313-331.

Vilagut, G., Forero, C. G., Barbaglia, G., & Alonso, J. (2016). Screening for depression in the general population with the center for epidemiologic studies depression (CES-D): A systematic review with meta-analysis. *PloS One, 11*(5), e0155431.

Vink, D., Aartsen, M. J., & Schoevers, R. A. (2008). Risk factors for anxiety and depression in the elderly: A review. *Journal of Affective Disorders, 106*(1-2), 29-44.

Wittchen, H., Beesdo, K., Bittner, A., & Goodwin, R. D. (2003). Depressive episodes–evidence for a causal role of primary anxiety disorders? *European Psychiatry, 18*(8), 384-393.

Wolitzky-Taylor, K. B., Castriotta, N., Lenze, E. J., Stanley, M. A., & Craske, M. G. (2010). Anxiety disorders in older adults: A comprehensive review. *Depression and Anxiety, 27*(2), 190-211.

Zavaleta, D., & Samuel, K. (2014). Social isolation: A conceptual and measurement proposal.

Zigmond, A. S., & Snaith, R. P. (1983). The hospital anxiety and depression scale. *Acta Psychiatrica Scandinavica, 67*(6), 361-370.

Zinbarg, R. E., Barlow, D. H., Liebowitz, M., Street, L., Broadhead, E., Katon, W., Richards, J. (1994). The DSM-IV field trial for mixed anxiety-depression. *American Journal of Psychiatry, 151*(8), 1153-1162.